## What is claimed is:

- 1. A method for measuring an indication of attributes of materials containing a fluid state, the method comprising the steps of:
- 5 providing a time-domain signal indicative of attributes of said materials in a single measurement;

constructing a time-domain averaged data train from said signal, the averaging being performed over one or more time intervals  $\Delta_i$ ; and

computing an indication of attributes of said materials from the time-domain averaged data train.

- 2. The method of claim? wherein said one or more time intervals  $\Delta_i$  are constant.
- The method of claim 1 wherein at least two of said one or more time intervals  $\Delta_i$  are different.
- 15 4. The method of claim 2 wherein the following expression is used to construct the time-domain averaged data train:

$$S_{\Delta}(t) = \int_{t}^{t+\Delta} dt' S(t') \wedge \Delta$$

- where  $S_{\Delta}(t)$  is the provided time-domain signal.
- 5. The method of claim 1, wherein the interval  $\Delta$  is fixed and the time-domain averaged data train is constructed at times  $t = t_0$ ,  $t_0 + \Delta$ ,  $t_0 + 2\Delta$ , ...,  $t_0 + N\Delta$ .
  - 6. The method of claim 1, wherein the time-domain signal is an NMR echo
- 25 train.
  - 7. The method of claim 6, wherein the step of computing an indication of attributes is performed using inversion of the constructed time-domain averaged data train into  $T_2$  domain.
- 8. The method of claim 7, wherein the  $T_2$  distribution is estimated using the 30 following expression

$$S_{\Delta}(t) = \sum_{T_2} \phi(T_2) \exp(-t/T_2) (1 - \exp(-\Delta/T_2)) + Noise$$

where  $\phi$  (T<sub>2</sub>) is the porosity corresponding to the exponential decay time T<sub>2</sub>.



The method of claim 1 further comprising the step of averaging two or more constructed time-domain averaged data trains to increase the signal-to-noise ratio (SNR) of the measurement.

5 A method for measuring an indication of attributes of materials containing a fluid state, comprising the steps of:

providing as NMR echo-train indicative of attributes of materials along the borehole;

constructing a time-domain averaged data train from said NMR echo train, the averaging being performed over one or more time intervals  $\Delta_i$ ; and

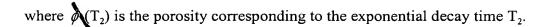
computing an indication of attributes a said materials from the time-domain averaged data train.

- 11. The method of claim 10 wherein said one or more time intervals  $\Delta_i$  are constant.
- 15 12. The method of claim 10 wherein at least two of said one or more time intervals are different.
  - 13. The method of claim 10 further comprising the step of averaging two or more constructed time-domain averaged data trains to increase the signal-to-noise ratio (SNR) of the measurement.
- 20 14. The method of claim 10 wherein the following expression is used to construct the time-domain averaged data train:

$$Echo_{\Delta}(t) = \int_{t}^{t+\Delta} dt' Echo(t') \Delta$$

- where  $Echo_{\Lambda}(t)$  is the provided time-domain signal over a time interval  $\Delta_{i}$ .
  - 15. The method of claim 10, wherein the time interval  $\Delta_i$  is constant and the time-domain averaged data train is constructed at times  $t = t_0$ ,  $t_0 + \Delta$ ,  $t_0 + 2\Delta$ , ...,  $t_0 + N\Delta$ .
  - 16. The method of claim 15, wherein the step of computing an indication of attributes is performed using inversion of the constructed time-domain averaged data train into T<sub>2</sub> domain.
  - 17. The method of claim 16, wherein the  $T_2$  distribution is estimated using the following expression

$$Echo_{\Delta}(t) = \sum_{T_2} \phi(T_2) \exp(-t/T_2) (1 - \exp(-\Delta/T_2)) + Noise$$



A method for increasing the spatial resolution of NMR logging measurements, comprising the steps of:

providing an NMR esho-train indicative of attributes of materials of interest; and constructing a time-domain averaged data train from said NMR echo train, the averaging being performed over one or more time intervals  $\Delta_i$ .

- 19. The method of claim 18 wherein said one or more time intervals  $\Delta_i$  are constant.
- 20. The method of claim 18 wherein at least two of said one or more time intervals A are different.
- 21. The method of claim 18 further comprising the step of averaging two or more constructed time-domain averaged data trains to increase the signal-to-noise ratio (SNR) of the measurement.
- 22. The method of claim 18 wherein the following expression is used to construct the time-domain averaged data train:

$$Echo_{\Delta}(t) = \int_{t}^{t+\Delta} dt' Echo(t') / \Delta$$

where  $Echo_{\Lambda}(t)$  is the provided time-domain signal.

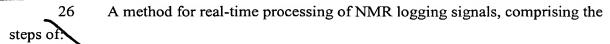
- The method of claim 18 wherein the time interval his constant and the time-domain averaged data train is constructed at times  $t = t_0, t_0 + \Delta, t_0 + 2\Delta, \dots, t_0 + N\Delta$ .
- The method of claim 23, wherein the step of computing an indication of attributes is performed using inversion of the constructed time-domain averaged data train into T2 domain.
- The method of claim 24wherein the T<sub>2</sub> distribution is estimated using the following expression

$$Echo_{\Delta}(t) = \sum_{T_2} \phi(T_2) \exp(-t/T_2)(1 - \exp(-\Delta/T_2)) + Noise$$

where  $\phi$  (T<sub>2</sub>) is the porosity corresponding to the exponential decay time T<sub>2</sub>.

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providing real-time data corresponding to a single-event NMR echo train indicative of physical properties of materials of interest;

constructing a time-domain averaged data train from said NMR echo train, the averaging being performed over time interval  $\Delta$  using the expression

$$S_{\Delta}(t) = \int_{t}^{t+\Delta} dt' S(t') / \Delta$$

where S(t) is the provided measurement signal, and the time-domain averaged data train is constructed at times  $t = t_0, t_0 + \Delta, t_0 + 2\Delta, \dots, t_0 + N\Delta$ ; and

computing in real time an indication of the physical properties of said materials based on the constructed time-domain averaged data train.

The method of claim 26, further comprising the step of inverting of the constructed time-domain averaged data train into the T<sub>2</sub> domain, wherein the T<sub>2</sub> distribution is modeled using the expression

$$Echo_{\Delta}(t) = \sum_{T_2} \phi(T_2) \exp(-t/T_2)(1 - \exp(-\Delta/T_2)) + Noise$$

where  $\phi$  (T<sub>2</sub>) is the porosity corresponding to the exponential decay time T<sub>2</sub>.

28. The method of claim 26, further comprising the step of averaging two or more constructed time-domain averaged data trains to increase the signal-to-noise ratio (SNR) of the measurement.

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